PhATS Technical Note

Achieving Total Sanitation

September 2015

SEPTAGE MANAGEMENT

ACHIEVING TOTAL SANITATION, PART I: EMERGENCY RESPONSE

In November of 2013, Typhoon Haiyan struck the Eastern Visayas region of the Philippines devastating homes and families in its path. The response by the government and international community was swift as shelter kits were distributed and "bunkhouse-style" temporary housing built for displaced persons. As these needs were met, new problems emerged, among them was how to properly manage the large quantities of localized human waste newly generated in the evacuation areas. The response was to develop septage management treatment plants to meet these new needs. Two such treatment plants were constructed in Tacloban City and Palo, Leyte, both plants utilize the lime stabilization method of treatment.

This report will cover an overview of the two septage management projects, discuss the challenges and successes of each system, and share best practices and lessons learned from lime stabilization in emergency settings.

PRE-HAIYAN SEPTAGE SETTING

Prior to the devastation of Typhoon Haiyan, the existing option for emptying of septic tanks in the Eastern Visayas region was largely dominated by private enterprises operating under no apparent government regulation. Broadly labeled as "Malabanan," these private companies would be hired by individual households to pump their full septic tanks. Because the households contacted the Malabanan on an as-needed basis, they would often have to pay a high one-time cost around 5000 to 6000php. The pumping process was simple from the homeowner's perspective: a large truck would hook up to the tank, remove the waste, and take it away. However, the process following pumping was considerably less straightforward as there were no systems in place to treat the human waste. Without treatment facilities, the Malabanan would often dump the collected raw sewage wherever was most convenient including in rivers and by roadsides, polluting the environment.

Many households were unable to afford the steep price of the Malabanan and still others were unaware that proper maintenance of septic systems required regular pumping. In both cases, these septic tanks were allowed to build up and overflow, leaking untreated waste into yards and neighborhoods.

POST-HAIYAN SEPTAGE SETTING

Following the destruction of Typhoon Haiyan, the need for a waste management system quickly became apparent. Based on Philippine Department of Social Welfare and Development records, 1,472,251 households were affected by typhoon Yolanda/Hayan with 918,261 households displaced. A total of 1,171,469 houses were damaged. In response, numerous displacement sites with emergency toilets were set up, housing nearly half a million people. Often, the emergency toilets were simple, portable systems without septic tanks for basic waste management. Soon, local governing bodies and non-governmental organizations (NGOs) working in the region were faced with a very large and rapidly expanding amount of raw sewage with no system in place to treat the sludge for safe entry into the environment.

In addition to emergency toilets, bunkhouses and transitional sites were built with very low quality septic tanks. Tanks which should have lasted several years before needing pumping, but were filled within eight months. A large quantity of centralized, untreated waste was rapidly accumulating, placing pressure on the government, UN agencies and NGOs to produce a solution.

In response, OXFAM GB (OXFAM) designed two lime stabilization waste treatment plants. Intended to be a temporary fix, the plants provided a solution to the emergency setting and set the stage for improving septage management in the long-term.

LIME STABALIZATION PROCESS

Lime stabilization is an effective, low-cost septage management method that treats septage by mixing it with hydrated lime (CaOH2). Hydrated lime raises the pH of the septage producing an environment that is uninhabitable for most pathogens. This process reduces the pathogen load, helps eliminate odors, and inhibits the regrowth of pathogens. The lime stabilization process has four key steps, which are summarized briefly in the following section.

1. THE FIRST STEP IN LIME STABILIZATION IS PRE-TREATMENT WHERE THE SEWAGE PASSES THROUGH TRASH SCREENS OR LARGE GRATING WITH OPENINGS BETWEEN TWO TO FIVE CENTIMETERS. THIS STEP REMOVES LARGE PIECES OF TRASH OR SOLID WASTE SUCH AS RAGS. IN SOME CASES, THE SEWAGE IS ALSO PASSED THROUGH A GRIT CHAMBER, WHICH SLOWS DOWN THE FLOW TO ALLOW SAND AND GRAVEL TO SETTLE AT THE BOTTOM FOR REMOVAL.

2. THE SECOND STEP IN THE PROCESS IS STABILIZATION. ONCE PASSED THROUGH THE TRASH SCREENS AND GRIT CHAMBER, SEWAGE IS POURED INTO LARGE REACTOR TANKS, WHICH CAN BE AS BASIC AS EARTHEN PITS LINED WITH PLASTIC. DURING THIS STEP, THE SEWAGE IS MIXED WITH HYDRATED LIME TO ELIMINATE THE MAJORITY OF PATHOGENS. THE RECOMMENDED RATIO FOR EFFECTIVE STABILIZATION IS 20 KG OF LIME FOR EVERY 4,000 LITERS OF SEPTAGE; HOWEVER, THIS CAN CHANGE DEPENDING ON A VARIETY OF FACTORS INCLUDING TEMPERATURE AND QUALITY OF LIME. THE COMBINED SEWAGE AND LIME MUST BE MIXED AT pH 12 FOR AT LEAST 30 MINUTES. IDEALLY, THE pH SHOULD BE MONITORED WITH A pH METER AS THE LIME IS MIXED IN TO ENSURE THAT THE MIXTURE REACHES AND STAYS AT pH 12. MIXING CAN BE DONE EITHER MECHANICALLY USING A PUMP, PADDLE, OR AIR BLOWER, OR MANUALLY USING A PADDLE.

3. THE THIRD STEP IS MOVING THE TREATED SEWAGE TO DRYING BEDS TO REMOVE THE REMAINING LIQUID THROUGH EVAPORATION AND UNDERDRAINS. THE DRYING BEDS HAVE SUBSEQUENT SAND AND GRAVEL LAYERS THAT ALLOW THE LIQUID EFFLUENT TO FLOW THROUGH FOR COLLECTION. ONCE FULLY DRIED, THE REMAINING SOLID IS SAFE TO RE-ENTER THE ENVIRONMENT AND CAN BE USED FOR A VARIETY OF PURPOSES INCLUDING AS LANDFILL COVER OR FERTILIZER.

4. THE FINAL STEP IN THIS PROCESS IS TREATING THE LIQUID EFFLUENT COLLECTED FROM THE DRYING BEDS. THIS SECONDARY TREATMENT CAN BE PERFORMED USING A SERIES OF SYSTEMS: AN ANAEROBIC BAFFLED REACTOR, A LAGOON OR CONSTRUCTED WETLAND, AND A DISINFECTION TANK. THESE THREE STEPS WILL EFFECTIVELY REDUCE THE PATHOGEN LOAD TO A SAFE LEVEL.

ABOVE: One of two emergency waste management sites in Yolanda-affected areas was located in the Municipality of Palo, Leyte. Mixing cells were constructed using coconut lumber (FAR LEFT), lined with plastic, filled with fecal sludge and mixed with lime (LEFT CENTER); the waste was then pumped (RIGHT CENTER) to one of many drying beds (FAR RIGHT) to conclude treatment.

ABOVE: The Tacloban City Septage Site fell into extreme dirsrepair with the lack of consistant management and exposure to extreme weather conditions such as Typhoon Ruby in December of 2014.

ANALYSIS OF LIME STABILIZATION

Lime stabilization is quick and easy to set up and does not require large areas of space compared to other sewage treatment methods, making it ideal for emergency settings. Here is a brief checklist to see if lime stabilization would work well in a given region.

YES/NO

- ☑ ☐ IS SPACE FOR THE SYSTEM LIMITED?
- ☑ ☐ IS HYDRATED LIME READILY AVAILABLE?
- ☑ ☐ IS THE TIME FOR CONSTRUCTION LIMITED?
- ☑ ☐ IS LABOR READILY AVAILABLE?

If the answer to all of these questions is yes, lime stabilization may be a good option for the area.

OVERVIEW OF PALO AND TACLOBAN CITY

Following the devastation of Typhoon Haiyan, the need for a septage management solution was undeniable. OXFAM responded quickly by creating two lime stabilization-based septage management sites in Palo and Tacloban City. Management of these sites was eventually handed over to two NGO partners: Catholic relief Services (CRS) in Palo and Save the Children (STC) in Tacloban. Lime stabilization was chosen as the best treatment method for two primary reasons: 1) time and space was limited following the disaster and lime stabilization provided a quick and easy option given those constraints 2) several OXFAM consultants and employees were familiar with the lime stabilization method and had experience constructing and managing lime stabilization plants.

TIMELINE

November 8, 2013
Typhoon Haiyan

December 2013
Both septage sites are completed and running

OXFAM eventually turns over both sites to two NGOs: OXFAM and Save the Children

The site was rebuilt through a partnership with UNICEF, SP, and BeSecure to be managed by Tacloban City government

CRS continues to manage the Palo site until present day

June 2014
Save the Children funds the Tacloban site while the city government manages operations

September 2014
Funding from STC ends and Tacloban City is unable to manage the site so it falls into disrepair

INITIATION

Both sites were initially developed by OXFAM in response to the need for septage management. Though septage management is included in OXFAM's general disaster response guidelines, the organization has little experience opening these systems in past disasters. Often septage management, which is generally a long-term project, is not prioritized or pursued in the rapid response to disasters or even in the early recovery phase. Nevertheless, in the case of Typhoon Haiyan, OXFAM saw a clear need for some sort of system to treat the large amounts of waste generated from the region's newly formed evacuation centers, bunkhouses, and transitional sites. This emergency response also was unique because OXFAM had access to consultants who not only had experience in septage management, but had constructed lime stabilization systems in the Philippines before. In response to the apparent needs and with the guidance of these experts, OXFAM constructed two lime stabilization sites in Tacloban City and Palo.

PALO AND TACLOBAN

CHALLENGES // LESSONS LEARNED

- Health hazard for employees due to improper training and failure to wear PPE Personal Protective Equipment (PPE), resulting in poor efficiency in construction and increased liability to the managing organization.
- No pH meter was available so it was impossible to ensure that a pH of 12 was met for at least 30 minutes. Recommendation to future septage endeavors would be to ensure the presence of a pH reader.
- Mixing was done manually rather than mechanically, which presented a greater health hazard and made it more difficult to reach and sustain a pH of 12 throughout the entire pit.
- Turnover was very challenging because unlike other septage site models the two emergency sites could not be shown to generate revenue (via user fees) and was therefore an undesirable acquisition for the respective local governments.
- Would have expanded to other areas if they'd known how quick and easy it would be; there was a lot of need that wasn't met by just the two sites

SUCCESSES

- Sparked an effort to improve permanent septage management systems in the region; this wouldn't have been a priority if the emergency septage response weren't pursued
- Long-term successes (in progress):
  - Will reduce costs of desludging for homeowners,
  - Will reduce pollution to the environment
  - Will created revenue for municipalities

SITE TURNOVER

OXFAM, transitioning from emergency and early response actions to more long-term development work, decided to turn over their temporary septage management systems. These systems were originally designed to be temporary solely to address the waste of evacuated persons; however, due to poor septic tank construction in the bunkhouses and transitional sites, the systems continued to be operated to treat the rapidly accumulating waste in these sites.

OXFAM's first approach was to turn the two systems over to their respective local governments, but they had little interest in managing the sites. From the government's perspective, the septage systems were not generating any profit and actually would be an added expense on their budgets. Because the government could not foresee a sizable benefit from managing the two systems, OXFAM instead turned to other NGOs to continue funding the sites with STC funding Tacloban City and CRS managing Palo. In the case of the Tacloban site, the government agreed to manage the site even though they lacked funds to support it financially. Starting in June of 2014, STC and the city government partnered to operate the site. However, when funding from STC ended in September, the city was no longer able to maintain the site and it was no longer operational. Through a partnership with BeSecure and UNICEF, Samaritan's Purse (SP) agreed to rebuild the site, given that the Tacloban City government would handle management and operations, once constructed.

PART II OF THIS REPORT WILL PROVIDE AN OVERVIEW OF SP'S INSTALLATION OF THE FIRST PERMANENT SEPTAGE MANAGEMENT PLANT IN THE REGION AS PART OF IMPLEMENTATION OF THE PHASED APPROACH TO TOTAL SANITATION.

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